Enhancing Medication Safety through PharmD-Led Medication Reconciliation: A Pilot Study at Community Health Camps in Underserved Areas

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ABSTRACT

The biggest problem is proposed on medication errors and negative drug events (ADEs) on general health, particularly in rural places where regular medical services are unavailable. Among the contributing factors, it is possible to note polypharmacy, low patient awareness, and the inconsistent medical history of multiple providers. The current pilot study evaluated the contribution of the PharmD professionals to the enhancement of medication safety in the context of rural health camps. There were 150 registered, and screened patients. Structured questionnaire was applied to ensure that clinical pharmacists confirmed the current use of medicines, history of prescriptions, and adherence. The medication-related errors that they detected were missed doses, duplication of therapy, dosing errors, and possible drug interactions. Therefore, the discrepancy of medications was settled in 38 percent of the cases, and the onset of ADEs was identified and managed in 22 percent of the patients. Counselling was also conducted on the drug usage, adherence strategies and side effects in addition to the review of the medication. The effect of the intervention was patient increased knowledge and adherence to treatment. The evidence stresses the primary concern of the PharmD professionals in the rural health delivery. They guarantee safer medication use, decrease unnecessary AEs, enhance patient literacy, and enhance adherence, which eventually results in improved health outcomes among underserved populations.

Keywords: Medication errors, Adverse drug events (ADEs), Medication reconciliation, Drug-related problems (DRPs).

INTRODUCTION

Background and Significance

Medication reconciliation- guaranteeing a detailed checklist of medications a patient is using such as the name of drugs, dose, frequency, route of administration is an important step towards medication safety in transition of care **[1,2].** International organizations such as World Health Organization (WHO) acknowledge the practice as one of the main interventions to enhancing medication safety in the world **[3]**. Effective medication reconciliation has not experienced proper implementation even though it is considered crucial in improving medication outcomes, especially in low- and middle-income countries (LMICs) where resources are very scarce in the healthcare system.

The adverse effect of ineffective medication reconciliation is fully known. Some patients suffer discrepancies in their medication regimes when they transition between healthcare settings **[4,5,6]**, up to 70 percent of patients, and the results can be adverse drug events (ADEs), emergency department visits, hospital

readmission, and excessive healthcare spending. A review study conducted by Tam et al. concluded that 10-67 percent of histories regarding drug history of patients consist of at least some mistakes, in almost one-third of which dangerous consequences were possible **[7,8]**.

Some groups face increased risks of making a medication error, such as people of older age, individuals with multiple oddities, people with low literacy in health matters, patients with limited access to medical care opportunities **[9,10]**. The effective medication management of such groups is always complicated due to the often-encountered challenges of polypharmacy, care fragmentation across providers, and inability to afford medications.

Community Health Camps and Healthcare Access in Rural India

People in rural India rely on community health camps because medical centres there are seldom adequate. At these clinics, there are usually a lot of patients, making it hard to keep track of their medicines **[11,12]**. At times, patients collect their medications from several pharmacies because they have been prescribed by several doctors, usually not fully aware of all the medicines they are taking. A number of rural patients are found not to understand their medication needs and how to take it properly **[13]**. Many of these camps prescribe a lot of medications and while there is a danger of unsafe drug mixtures, unexpected therapy or wrong medicine doses, these issues are hardly ever recognized since the camps operate quickly. Errors in giving medications are more common when there are no dependable ways to confirm whether treatment is given correctly. Many drug-related problems in animals could have been avoided in India, but they are more common in rural areas since there is not enough care available **[14,15,16]**.

Role of Clinical Pharmacists in Medication Safety

According to the WHO, there are global issues with patients properly following their medication instructions, based on evidence that less than half of these patients are able to do so **[17]**. When people do not stick to their medications, along with medication mistakes and problems, it increases the chances of preventable disease and death globally. The financial cost of mistakes in prescribing medication is estimated to be $42 billion each year which makes up for nearly 1% of the money spent on health care around the world **[18]**.

Incorporating clinical pharmacists with other medical staff is now proven to address these concerns. Those who have gone through specialized training in pharmacy, i.e. Doctor of Pharmacy professionals, offer special knowledge in managing medications that is helpful for physicians and nurses **[19].** The study by Mekonnen et al. proved that pharmacy-run medication reconciliation programs decreased errors in medications by 66%, reduced closures at the emergency department by 47% and cut hospital readmissions by 19% **[20]**.

Clinical pharmacists contribute to medication safety through multiple mechanisms, including:

- Make sure to ask for details of all a person's medications and match them with what is on the record.
- Spotting and addressing issues involving the use of drugs
- Giving individualized medication information to patients
- Monitoring medicines in the body and finding the proper dosage
- Working side by side with physicians to make sure that treatments are as effective as possible
- Targeted interventions have been effective in improving people's use of prescribed drugs **[21,22]**

When clinical pharmacy services are already established, these actions have regularly improved both the steps taken (reducing discrepancies in medication orders) and the outcomes (lowering healthcare visits and the number of side effects) **[23,24]**. This study found that in hospitals with clinical pharmacists, medication-related harm decreased by 51%, there were fewer ADEs by 45% and mortality was much lower in comparison with those that did not have clinical pharmacy services **[25]**.

The Emerging Role of PharmD Professionals in India's Healthcare System

In 2008, India created the PharmD program to help train pharmacists who can handle new changes in the use of medicine **[26]**. They must be able to accurately do medication reconciliation, monitor the use of drugs and

inform patients properly **[27]**. Even so, since they are starting to be recognized within Indian medicine, more research is needed to form helpful models. Evidence from a few studies shows that PharmD professionals are crucial in clinical places. Pharmacist counselling in South India improved the use of medications by patients with chronic illnesses and doctors no longer worried about many risks caused by drugs because of what the pharmacists did in the hospital. Moreover, PharmD professionals take part less in community outreach and are missed in important programs, especially in camps for underserved areas where much more research should happen **[28,29,30]**.

Rationale and Aim of the Present Study

Since these safety considerations are not unique to the rural and semi-urban health camping settings and the manifested clinical utility of the PharmD services is substantiated in the knowledge base, advancing opportunities of PharmD-led medications reconciliation in such settings is important. It has been revealed that clinical pharmacists can minimize the occurrence of medication errors and improve patient outcomes in multiple healthcare settings **[31,32]**. Nonetheless, they are underutilized in health camps, most of which serve underserved and high-risk groups of people.

This research study aims to find out whether a systematic medication reconciliation approach under the guidance of PharmDs in health camps can play a step towards reducing the existing gaps in patient education and treatment compliance and medication safety. In particular, it will aim at recording the kind of discrepancies that the pharmacists discover, the measures taken to rectify them, and the degree to which the healthcare providers embrace the mitigation steps. Moreover, the research evaluates how the pharmacist-driven counselling may influence the awareness of patients about their prescriptions, their ability to follow advice, and their satisfaction with the treatment they have received.

This study concentrates on this frequently ignored location to assess the ways to improve PharmD leadership in community health interventions by enhancing its results among underrepresented communities.

Aim And Objectives:

Aim: The aim is to check if using PharmD-led medication reconciliation during community health camps can decrease medication discrepancies and enhance patient safety.

Objectives:

- To ensure that patients attending health camps have all their medications checked for accuracy.
- To discover any mistakes in medications and possible problems related to them.
- To meet with patients and provide counselling to solve the problems found.
- To examine how properly patients and physicians respond to pharmacist interventions.

METHODOLOGY

Study Design - Prospective Interventional Pilot Study

The study will enroll participants and observe them as they go forward in time after the interventional step is taken. Since it is a pilot study, the main purpose is to verify the safety, feasibility and first success of the approach in a few subjects before trying it on a larger group. This design makes it possible to track the results right after the intervention and update steps for bigger studies.

Study Duration- 3 Months

Research will take place for three whole months. Selecting this amount of time lets the team carry out the intervention, observe changes in patients and gather additional data after treatment. The time needed for the study matches how fast changes happen with how much it costs and the chance that participants will not leave the trial.

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Sample Size- 150 Patients

The research will involve 150 patients. This size of the sample is suitable for the pilot study to assess the intervention's effectiveness and security before the larger study. Such assessment aids in predicting successful recruitment and also helps figure out parameters such as effect size and variability, used to decide how many participants should be recruited for bigger trials.

Study Setting- Health Camps Organized in Rural and Semi-Urban Areas Across Three Locations

The research will be conducted at health camps set up in rural and semi-urban regions across three different areas. Camps offer these populations, who might not be able to visit a healthcare facility, a way to get medical help. Working at a number of places can expand who takes part in the research and make the results easier to apply to different people and places. All necessary staff and tools will be available at the health camps to carry out the procedure and take care of the participants.

Study Criteria

Inclusion Criteria:

- People aged over 18 years.
- At least one prescription medication being taken by the patient.
- Informed consent from patients.

Exclusion Criteria:

- Patients who are seriously ill.
- People who refuse to take part in research.

Procedure

Pharmacists (PharmD interns working with supervisors) obtained information about each patient's history using a prepared data collection form that covered their age, medical background, the medicines they take and allergies. All the possible discrepancies were grouped as follows:

- Omission
- Duplication
- Incorrect dosage/frequency
- Drug-drug interactions
- Therapeutic duplication

Interventions involved recording problems, giving advice on how to use the medication, consulting with the doctor for prescription updates and handing out information leaflets to patients. The patients' acceptance of advice from their pharmacist was noted.

EXPANDED RESULTS

Demographic Characteristics

Table 1: Demographic Characteristics of Study Participants (n=150)

Table 1 presents the demographic profile of the 150 participants. The average age was 52.4 ± 13.8 years, with a higher proportion of females (58%) than males (42%). A considerable number of participants had limited education, with 28% reporting no formal education and only 10.7% having pursued higher education. Employment data showed 38.7% were employed, while others were unemployed (20.7%), housewives

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(29.3%), or retired (11.3%). Nearly half (47.3%) had a monthly income below INR 5,000, indicating socioeconomic constraints that may influence healthcare access and medication adherence.

Characteristic	Value
Age (years), Mean ± SD	52.4 ± 13.8
Gender, n (%)	
Male	63 (42.0)
Female	87 (58.0)
Educational Status, n (%)	
No formal education	42 (28.0)
Primary education	53 (35.3)
Secondary education	39 (26.0)
Higher education	16 (10.7)
Employment Status, n (%)	
Employed	58 (38.7)
Unemployed	31 (20.7)
Housewife	44 (29.3)
Retired	17 (11.3)
Monthly Income (INR), n (%)	
<5,000	71 (47.3)
5,000-10,000	48 (32.0)
10,001-15,000	19 (12.7)
>15,000	12 (8.0)

These findings underscore the need for targeted interventions in low-income, low-literacy rural populations who are more susceptible to medication-related issues.

Clinical Characteristics

Table 2: Distribution of Medical Conditions Among Study Participants (n=150)

Table 2 outlines the distribution of medical conditions. Hypertension (44.7%) and type 2 diabetes (36.0%) were the most prevalent chronic illnesses. Other common conditions included dyslipidemia (26.0%), gastritis/GERD (20.7%), and arthritis (14.7%).

Medical Condition	n	%
Hypertension	67	44.7
Type 2 Diabetes	54	36.0
Asthma/COPD	18	12.0
Dyslipidemia	39	26.0
Arthritis	22	14.7
Gastritis/GERD	31	20.7
Thyroid disorders	19	12.7
Cardiovascular diseases	15	10.0
Neurological disorders	7	4.7
Others	23	15.3

The high burden of NCDs emphasizes the importance of chronic disease management and medication reconciliation in rural settings.

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Table 3: Comorbidity Pattern Among Study Participants (n=150)

Table 3 shows that 39.3% of participants had two chronic conditions, and 29.3% had three or more, suggesting a substantial comorbidity load.

Number of Chronic Conditions	n	%
1	47	31.3
2	59	39.3
3	29	19.3
≥4	15	10.0

This multimorbidity further complicates pharmacotherapy, heightening the risk of drug-related problems.

Table 4: Medication Utilization Pattern (n=150)

Table 4 indicates that polypharmacy was common, with the average patient taking 4.2 ± 2.3 medications. Most (41.3%) used 3–4 medications, while 8.7% took seven or more.

Number of Medications	n	%
1-2	38	25.3
3-4	62	41.3
5-6	37	24.7
≥7	13	8.7
Total	**150**	**100**
Mean ± SD	4.2 ± 2.3	

These figures highlight the increased potential for medication discrepancies and adverse drug events in the population.

Medication Discrepancies

Table 5: Types and Frequencies of Medication Discrepancies Identified (n=150)

Table 5 summarizes the types of medication discrepancies found. The most frequent was omission (34%), followed by incorrect dose/frequency (28%), and drug-drug interactions (14%).

Type of Discrepancy	n	%	95% CI
Omission	51	34.0	26.5-41.5
Incorrect dose/frequency	42	28.0	20.9-35.1
Drug-drug interactions	21	14.0	8.5-19.5
Therapeutic duplication	18	12.0	6.8-17.2
Incorrect administration	15	10.0	5.2-14.8
Contraindication	9	6.0	2.2-9.8
Adverse drug reaction	13	8.7	4.2-13.2
Incorrect duration	11	7.3	3.1-11.5

Omission and dosing errors accounted for over 60% of all discrepancies, indicating gaps in accurate medication documentation and continuity of care.

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Table 6: Distribution of Medication Discrepancies by Age Group

Table 6 reveals that older patients had significantly more discrepancies, with those over 60 years averaging 3.4 ± 1.6 errors ($p < 0.001$).

Age Group (years)	Number of Patients	Mean Discrepancies per Patient ± SD	p-value
18-40	32	1.3 ± 0.8	<0.001
41-60	73	2.1 ± 1.2	
>60	45	3.4 ± 1.6	

Statistically significant ($p<0.05$), One-way ANOVA

This age-related trend stresses the vulnerability of elderly patients and the need for focused pharmacist review in this group.

Table 7: Distribution of Medication Discrepancies by Number of Medications

Table 7 shows a direct correlation between the number of medications and discrepancies. Patients taking ≥7 drugs averaged 4.2 discrepancies versus 0.9 for those taking only 1–2 ($p < 0.001$).

Number of Medications	Number of Patients	Mean Discrepancies per Patient ± SD	p-value
1-2	38	0.9 ± 0.6	<0.001
3-4	62	1.8 ± 0.9	
5-6	37	2.7 ± 1.3	
≥7	13	4.2 ± 1.7	

Statistically significant ($p<0.05$), One-way ANOVA

The data clearly links polypharmacy with increased medication errors, reinforcing the value of pharmacist-led reconciliation in such cases.

Medication Classes Involved in Discrepancies

Table 8: Medication Classes Involved in Discrepancies (n=180 discrepancies)

Table 8 lists drug classes most often involved in discrepancies. Antihypertensives (23.9%) and antidiabetic agents (21.7%) were the top culprits, followed by NSAIDs (15%).

Medication Class	n	%
Antihypertensives	43	23.9
Antidiabetic agents	39	21.7
NSAIDs	27	15.0
Cardiovascular agents	21	11.7
Antiplatelet/Anticoagulants	18	10.0
Respiratory medications	12	6.7
Gastrointestinal medications	10	5.6
CNS medications	9	5.0
Others	11	6.1

These classes reflect the most commonly used medications among patients with chronic diseases, and thus, should be key targets in pharmacist-led reviews.

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Clinical Significance of Discrepancies

Table 9: Clinical Significance of Identified Discrepancies (n=180)

Table 9 categorizes discrepancies by potential clinical impact. While most were minor (55.0%), 37.2% were moderate, and 7.8% were major, carrying serious health risks.

Significance Level	Definition	n	%
Major	Could result in death, permanent disability, or prolonged hospitalization	14	7.8
Moderate	Could exacerbate the patient's condition, require additional treatment or hospitalization	67	37.2
Minor	Would not likely cause harm or require additional monitoring	99	55.0

These findings illustrate that nearly half of all discrepancies could have significant clinical consequences if not addressed.

Pharmacist Interventions

Table 10: Types of Pharmacist Interventions (n=180)

Table 10 details pharmacist interventions. The most common was adding omitted medications (28.3%), followed by dose/frequency adjustments (23.3%).

Type of Intervention	n	%
Addition of omitted medication	51	28.3
Dose/frequency adjustment	42	23.3
Discontinuation of unnecessary medication	29	16.1
Therapeutic substitution	19	10.6
Change in administration timing	16	8.9
Addition of missing indication	13	7.2
Change in duration	10	5.6

This proactive role demonstrates how pharmacists directly corrected issues that could lead to suboptimal treatment or harm.

Table 11: Acceptance Rate of Pharmacist Interventions by Healthcare Providers

Table 11 shows high acceptance of interventions by healthcare providers—83.9% overall—with the highest acceptance for changes in administration timing (93.8%) and dose adjustments (90.5%).

Intervention Type	Number of Interventions	Accepted n (%)	Partially Accepted n (%)	Rejected n (%)
Addition of omitted medication	51	41 (80.4)	7 (13.7)	3 (5.9)
Dose/frequency adjustment	42	38 (90.5)	2 (4.8)	2 (4.8)
Discontinuation of unnecessary medication	29	23 (79.3)	3 (10.3)	3 (10.3)
Therapeutic substitution	19	14 (73.7)	3 (15.8)	2 (10.5)
Change in administration timing	16	15 (93.8)	1 (6.2)	0 (0.0)
Addition of missing indication	13	11 (84.6)	1 (7.7)	1 (7.7)
Change in duration	10	9 (90.0)	1 (10.0)	0 (0.0)
Overall	**180**	**151 (83.9)**	**18 (10.0)**	**11 (6.1)**

These high acceptance rates affirm pharmacists' credibility and effectiveness in clinical decision-making during rural outreach.

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Patient-Related Outcomes

Table 12: Patient Knowledge Assessment Before and After Counseling (n=150)

Table 12 indicates substantial improvement in patient knowledge post-counseling, with all parameters (e.g., name, purpose, dosage, adverse effects) significantly improving ($p < 0.001$).

Knowledge Parameter	Pre-Intervention Mean Score ± SD	Post-Intervention Mean Score ± SD	Mean Difference	p-value
Name of medication	2.1 ± 0.9	3.6 ± 0.7	1.5	<0.001
Purpose of medication	2.3 ± 1.0	4.1 ± 0.6	1.8	<0.001
Dosage regimen	2.7 ± 0.8	4.3 ± 0.5	1.6	<0.001
Adverse effects	1.2 ± 0.6	3.5 ± 0.8	2.3	<0.001
Storage conditions	1.5 ± 0.7	3.8 ± 0.6	2.3	<0.001
Overall score	9.8 ± 2.5	19.3 ± 2.1	9.5	<0.001

Scoring: 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent; Statistically significant ($p<0.05$), Paired t-test

This reflects the educational impact of pharmacist counseling, which is essential in low-literacy populations.

Table 13: Patient Satisfaction with Pharmacist Services (n=150)

Table 13 reports high patient satisfaction, with overall scores averaging 4.3 out of 5. The highest rating was for clarity of instructions (4.4 ± 0.5).

Satisfaction Parameter	Mean Score ± SD (Scale 1-5)
Quality of information provided	4.3 ± 0.6
Communication skills	4.2 ± 0.7
Time spent with patient	4.1 ± 0.8
Clarity of instructions	4.4 ± 0.5
Material provided (leaflets)	3.9 ± 0.9
Overall satisfaction	4.3 ± 0.6

Scoring: 1=Poor, 2=Fair, 3=Good, 4=Very Good, 5=Excellent

Patient satisfaction validates the communication effectiveness of pharmacists and the perceived value of their services.

Table 14: Medication Adherence Assessment Before and After Intervention (n=150)

Table 14 presents medication adherence improvements. High adherence increased from 20.7% to 38.7%, and low adherence dropped from 48.0% to 15.3% ($p < 0.001$).

Parameter	Pre-Intervention n (%)	Post-Intervention n (%)	p-value
High adherence (MMAS-8 score: 8)	31 (20.7)	58 (38.7)	<0.001
Medium adherence (MMAS-8 score: 6-7)	47 (31.3)	69 (46.0)	<0.001
Low adherence (MMAS-8 score: <6)	72 (48.0)	23 (15.3)	<0.001
Mean MMAS-8 Score ± SD	5.6 ± 1.8	7.1 ± 1.3	<0.001

*MMAS-8: 8-item Morisky Medication Adherence Scale; Statistically significant ($p<0.05$), Chi-square test for proportions, paired t-test for mean scores.

Improved adherence directly ties back to pharmacist intervention, contributing to better health outcomes and treatment success.

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Cost Analysis

Table 15: Economic Impact of Pharmacist Interventions

Table 15 shows the economic impact. The average cost saved per patient was INR 453.25, with a total savings of INR 67,987.50 and a cost-benefit ratio of 5.3:1.

Parameter	Value
Average cost saved per patient (INR), Mean ± SD	453.25 ± 189.62
Total cost saved for all patients (INR)	67,987.50
Projected annual savings for similar population (INR)	271,950.00
Cost of pharmacist intervention per patient (INR), Mean ± SD	85.40 ± 23.75
Cost-benefit ratio	5.3:1

These Table highlight that pharmacist-led medication reviews are not only clinically effective but also economically efficient, offering a high return on investment.

DISCUSSION

This paper supports that medication reconciliation is a necessity in the outreach programs within the community, especially in underserved rural communities. As it was observed in the present study, which aligns with the available literature, omission was found to be the most widespread type of a discrepancy, particularly in older adults and in individuals with several chronic conditions. Such remarks do not contradict the past research findings that indicated geriatric and polymorbid patients are highly susceptible to medication errors **[33,34].**

A strong correlation between polypharmacy and medication discrepancies was identified multidimensionally with polypharmacy and likelihood of errors as an increasing factor. The phenomenon was also reported in previous research, proving the fact that patients on complex regimens are more likely to experience discrepancies and possible harm **[33,34].** In our study, statistically more discrepancies were found in the elderly population (mean 3.4 +/- 1.6), which can be explained by previous research results reporting a higher level of medication-related problems in geriatric population groups **[35].**

Notably, the fact that the pharmacist interventions acceptance rate by the healthcare providers is high (83.9%) corroborates with the premise that clinical pharmacists play an integrative role in medication management. This acceptance rate was consistent with other scholarly investigations that showed a rate between 70% to 92% **[36,37]**, which further supports the validity and the usefulness of pharmacist suggestions. Specifically, interventions which concerned timing of medication (93.8%) and dose adjustments (90.5%) were most popularly accepted in terms of prescriber confidence in these interventions.

It was also shown that patient knowledge increased strongly with an improvement of 2.3 points out of 5 in the areas of adverse effects, and storage instructions after a pharmacist-based counselling ($p < 0.001$). The findings correlate with the past studies that indicated the positive effects that pharmacist education have on patient awareness and interaction with their medication **[38,39].**

Economically, the cost-benefit analysis demonstrated that the pharmacist-led interventions were associated with a potential savings of about five rupees of the healthcare cost spend per rupee. This observation complements earlier economic analyses that recommend full integration of clinical pharmacists into the primary care and community health initiatives as cost-efficient measures **[40].**

Irrespective of these positive results, this study also has a number of limitations. To begin with, it is a pilot study, and a rather small sample size (n=150) might hamper generalizability. The short follow-up period was the second limitation, which limited our capacity to report about the long-term clinical outcomes. Finally, the research was performed in one rural health camp, and the results might not be relevant to medications in the different areas of the country, as in rural or urban settlements.

However, there is strong evidence by this study to indicate that introduction of PharmD professionals to rural outreach programming is effective in enhancing medication safety, patient education and adherence as well as significant cost savings. These results should be confirmed by large-scale studies in a variety of settings in the future to influence policy.

CONCLUSION

This paper has proved that medication reconciliation programs by pharmacists carried out during health camps would help to substantially decrease the number of medication errors, and improve drug safety of any population in underserved regions. It has been shown that the changes in this way enhanced the amount of medication that patients received, enhanced their knowledge on drugs, motivated them to take drugs properly, and reduced the treatment costs. The presence of clinical pharmacists in primary healthcare programs may benefit the management of medications of patients and cause patient treatment to become more individualized. Based on these results, it makes a valid point to argue that the national health policy should incorporate the formal assimilation of PharmD professionals into the model of health resource delivery in the rural areas. They can leverage their participation to resolve medication safety gaps and facilitate more rational drug use and potentially more equitable and efficient care. Despite supportive results, they could be confirmed in bigger and multicentric researches. Significantly, this evidence should be used in making policy decisions that will enable the sustainable integration of clinical pharmacists in the community health activities in the future.

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